United States Patent [19]

Takiguchi et al.

[11] **Patent Number: 4,779,741**

[45] **Date of Patent: * Oct. 25, 1988**

[54] **SORTING DEVICE**

[75] Inventors: **Kiyoaki Takiguchi,** Yokohama; **Seigo Takano,** Tokyo, both of Japan

[73] Assignee: **Computer Services Corporation,** Tokyo, Japan

[*] Notice: The portion of the term of this patent subsequent to Aug. 20, 2002 has been disclaimed.

[21] Appl. No.: **21,549**

[22] Filed: **Feb. 27, 1987**

Related U.S. Application Data

[60] Continuation of Ser. No. 742,693, Jun. 7, 1985, abandoned, which is a division of Ser. No. 470,720, Feb. 28, 1983, Pat. No. 4,535,898.

[30] **Foreign Application Priority Data**

Apr. 13, 1982	[JP]	Japan	57-61308
Apr. 20, 1982	[JP]	Japan	57-66534
Apr. 24, 1982	[JP]	Japan	57-69213
Apr. 27, 1982	[JP]	Japan	57-70625
May 11, 1982	[JP]	Japan	57-79298
May 11, 1982	[JP]	Japan	57-79299

[51] **Int. Cl.**[4] **B07C 1/10;** B07B 13/65
[52] **U.S. Cl.** **209/683;** 209/664
[58] **Field of Search** 209/683, 684, 687, 680, 209/659, 664, 284, 288, 392, 443

[56] **References Cited**

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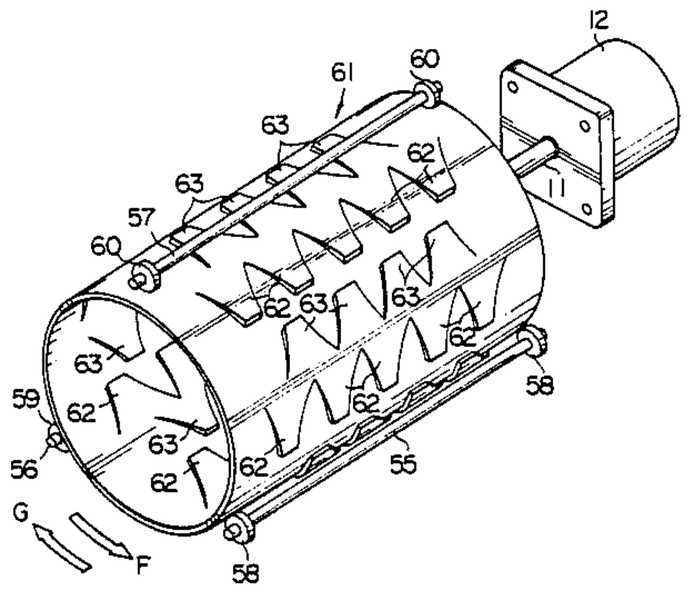
Primary Examiner—Robert B. Reeves
Assistant Examiner—Donald T. Hajec
Attorney, Agent, or Firm—Koda and Androlia

[57] **ABSTRACT**

A sorting device for sorting out a multiplicity of pieces such as tickets according to their size including a cylindrical sorting drum rotatably mounted in a frame for storing therein pieces having different sizes to be sorted out, a first row of openings and associated tapered tongues for only passing therethrough pieces of a first particular size, a second row of openings and associated tapered tongues for only passing therethrough pieces of a second particular size, and a motor for rotating the sorter drum about its own axis to cause the pieces of the particular sizes to be discharged through the first and second rows of openings in the sorter drum.

4 Claims, 11 Drawing Sheets



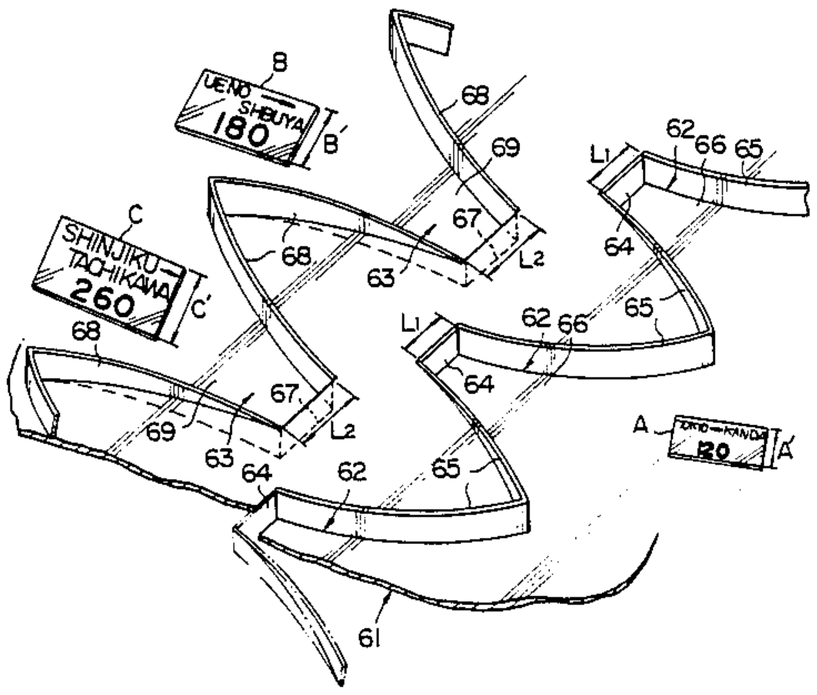


FIG. 1

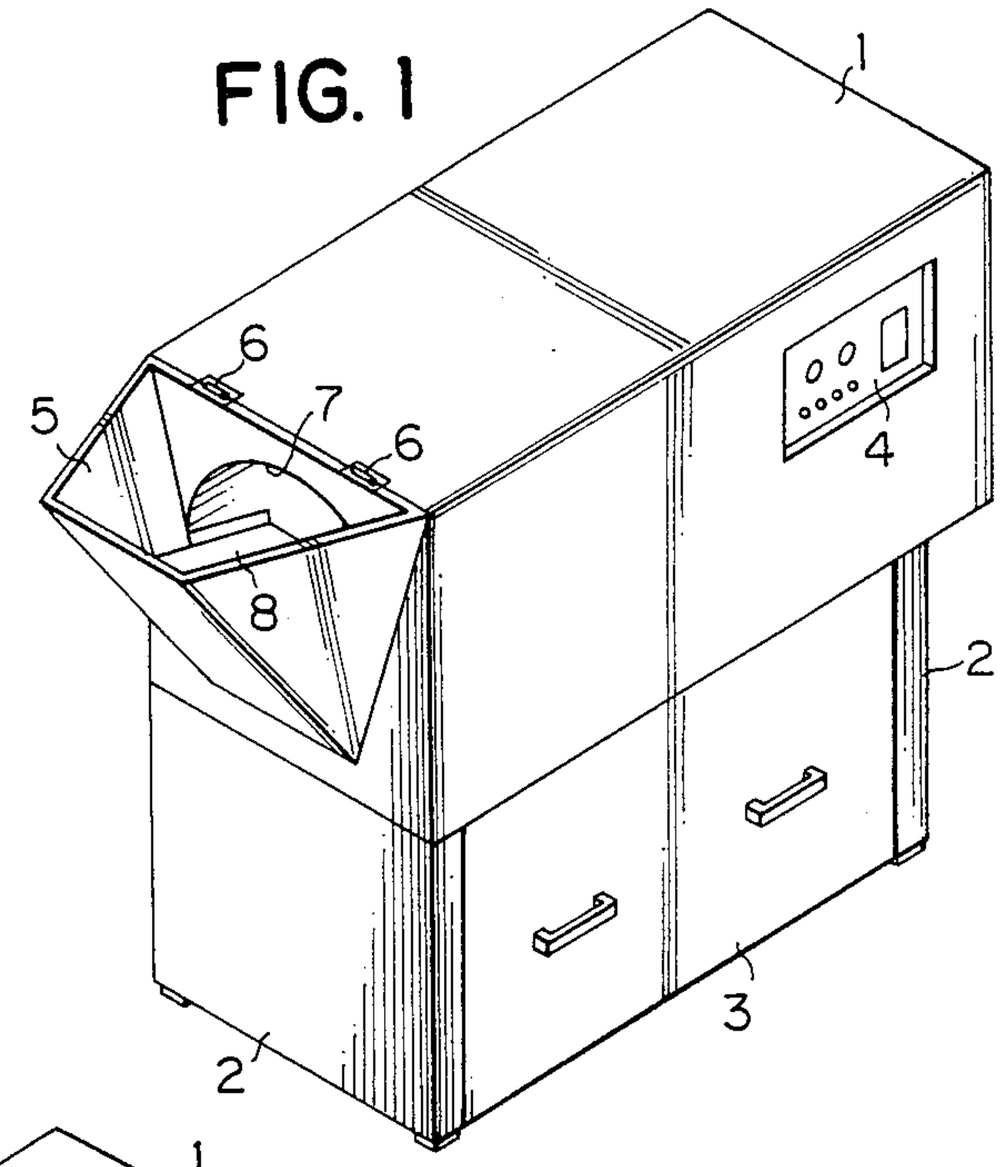
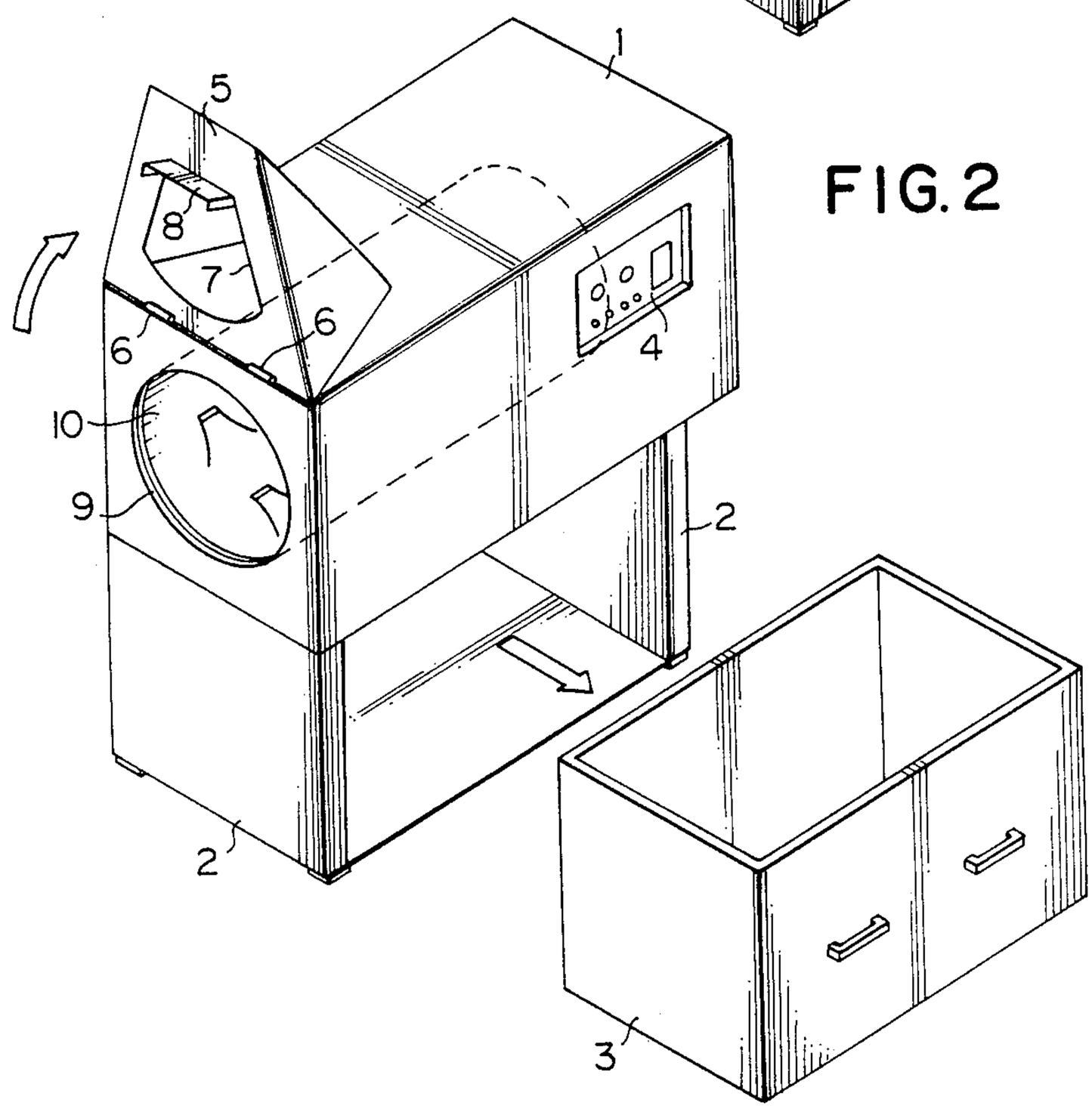


FIG. 2



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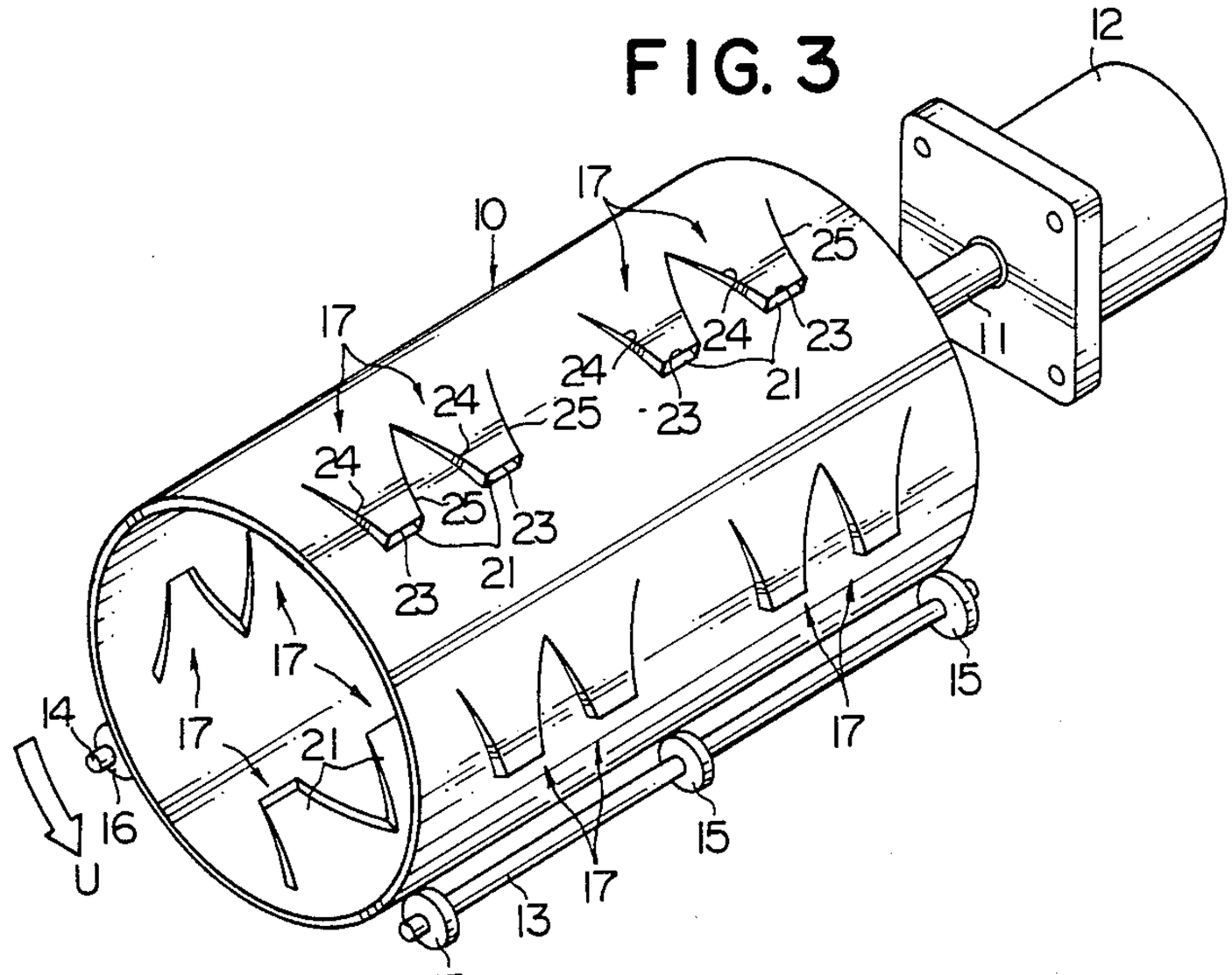
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10
17
25
24
23
11
21
24
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17
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U
15
17
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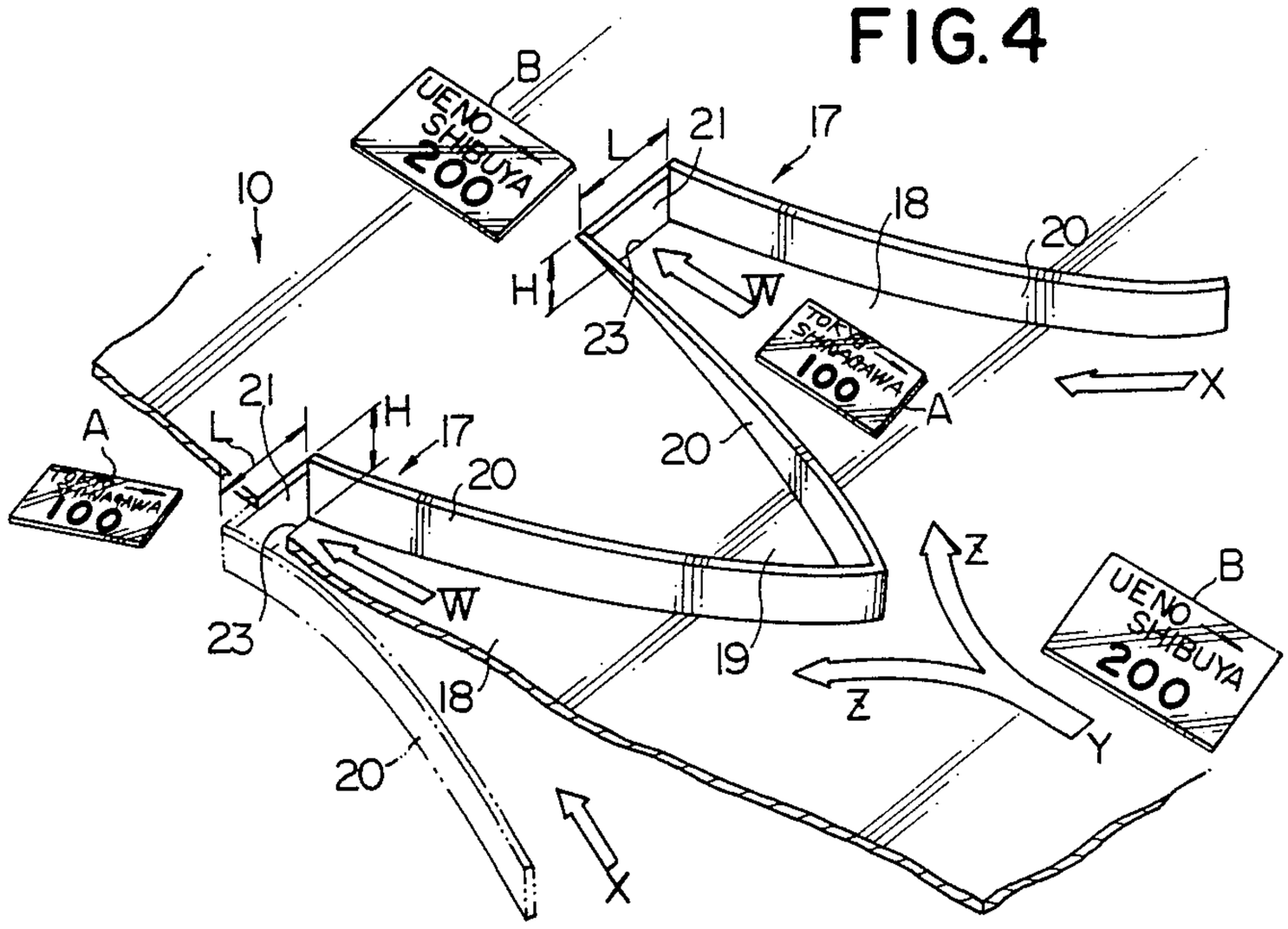
13
17

FIG. 4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21
H
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L
A
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Y
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FIG. 5

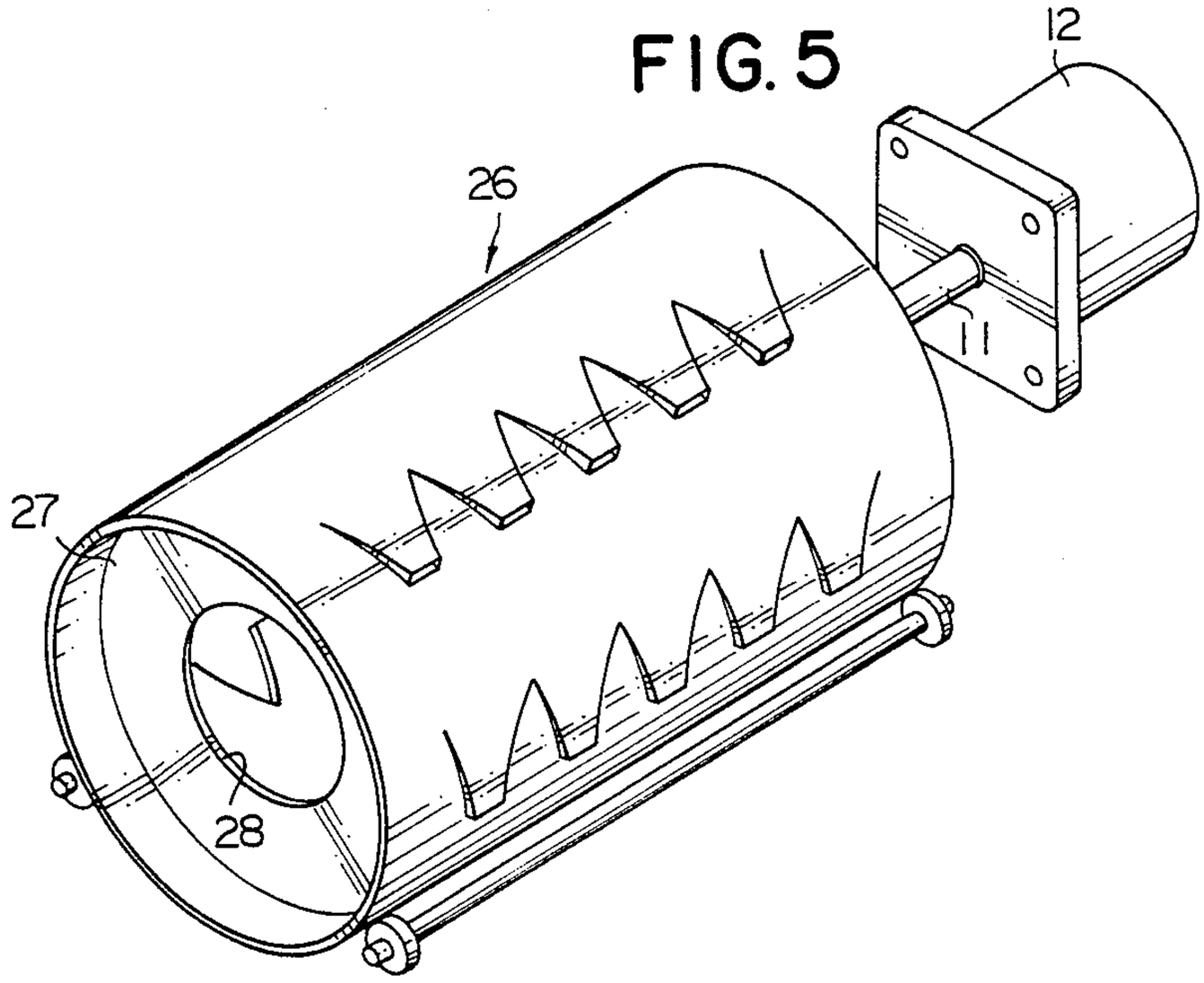

FIG. 6

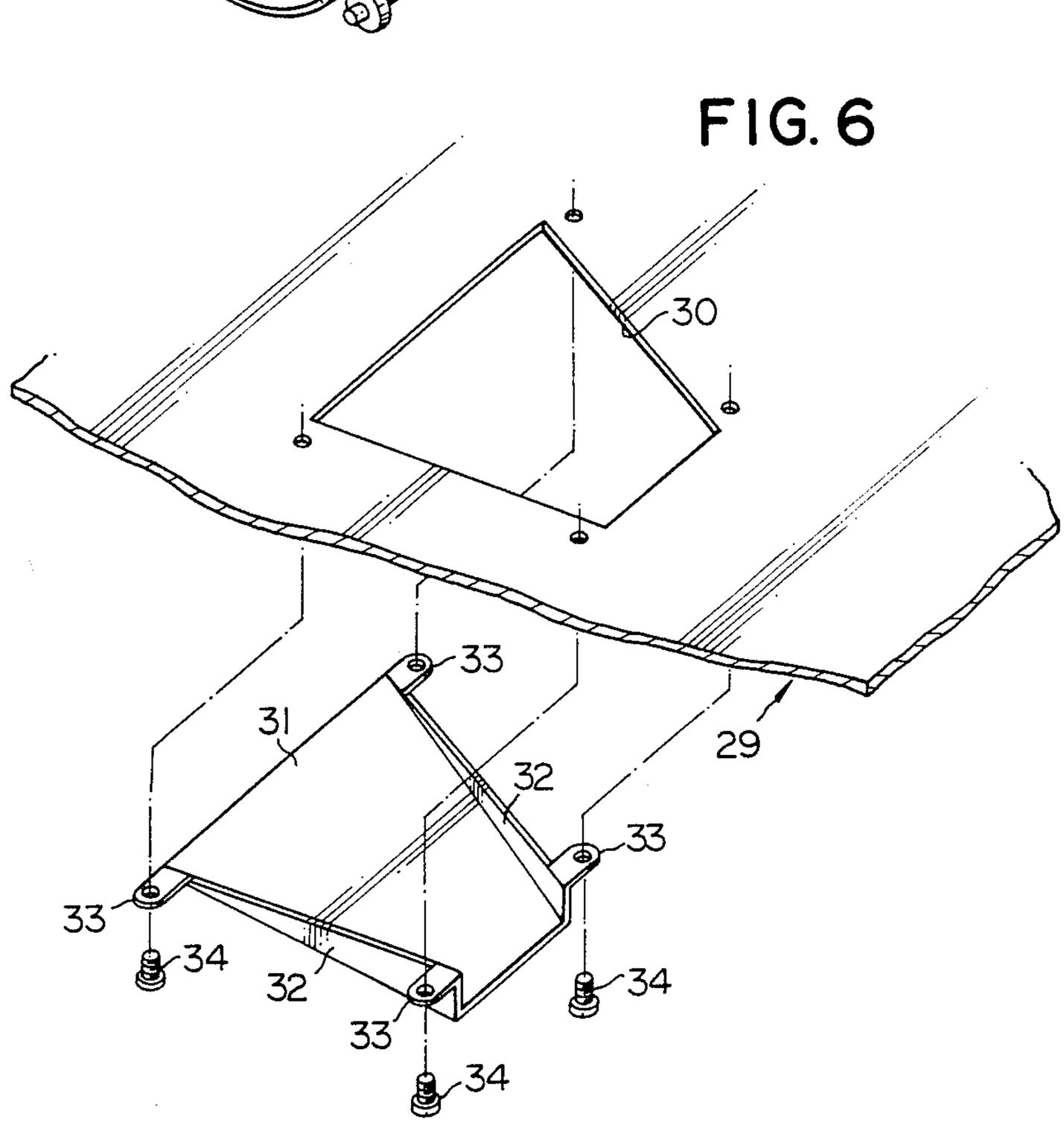

FIG. 7

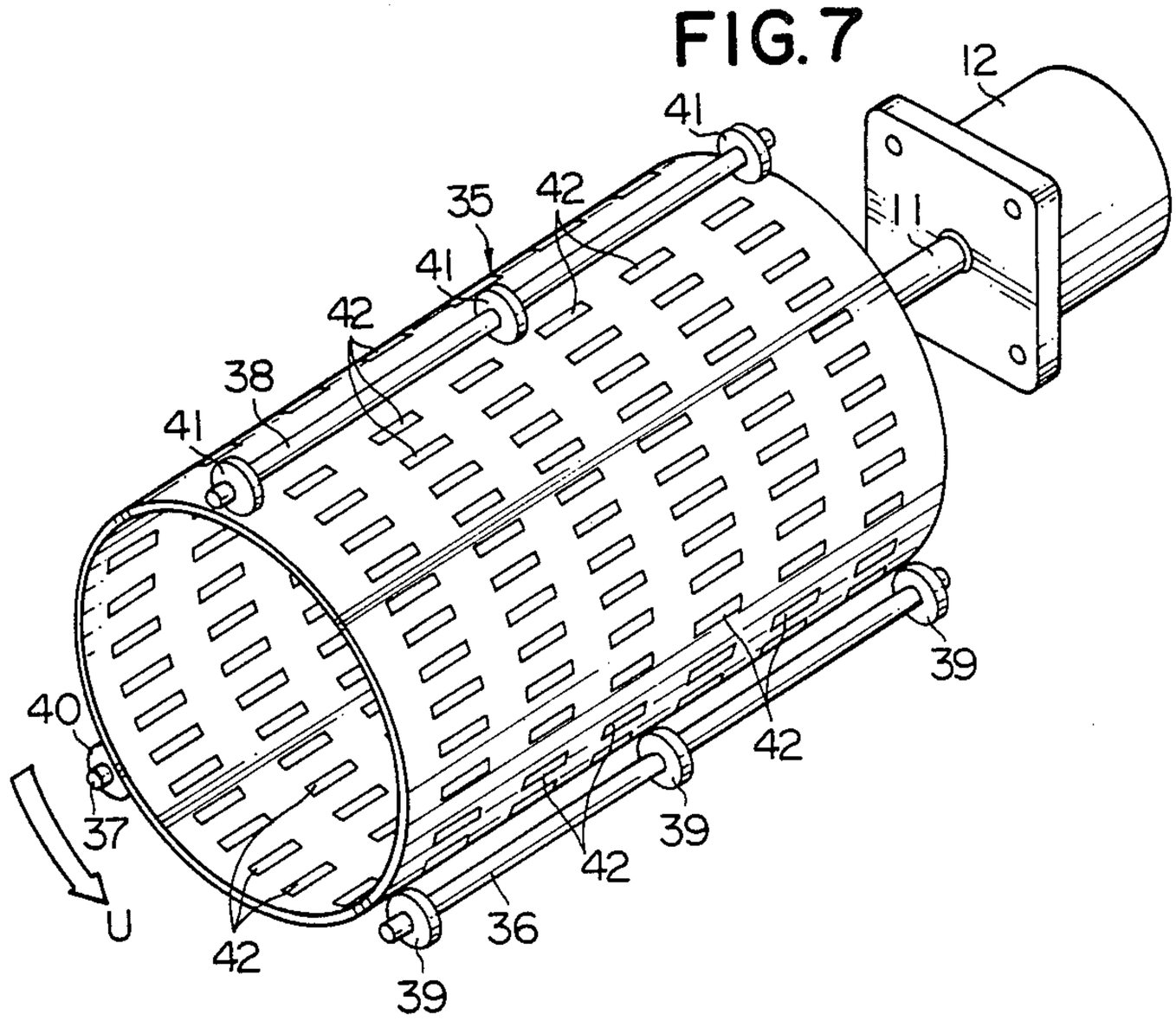
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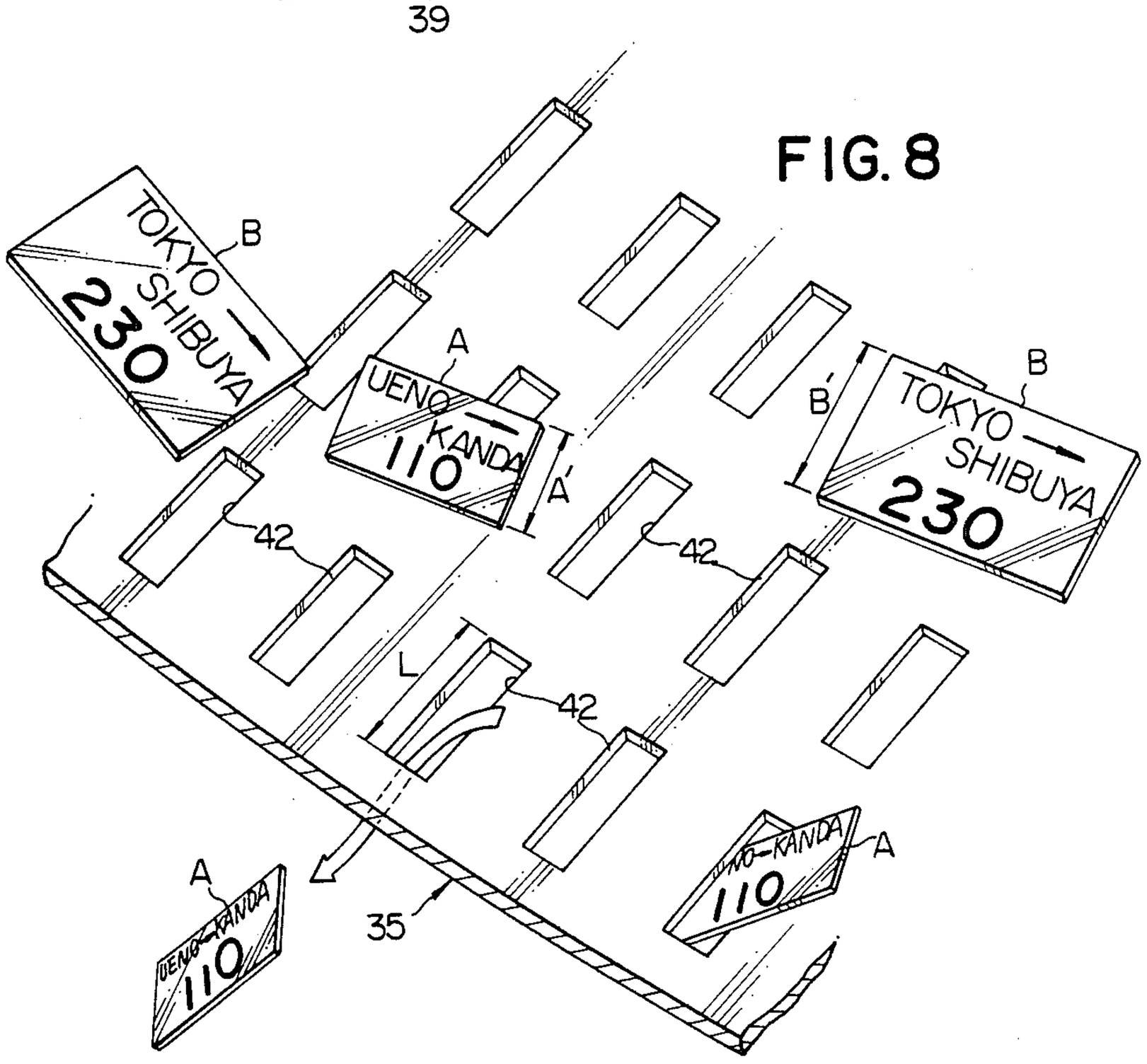
FIG. 8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110
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FIG. 9

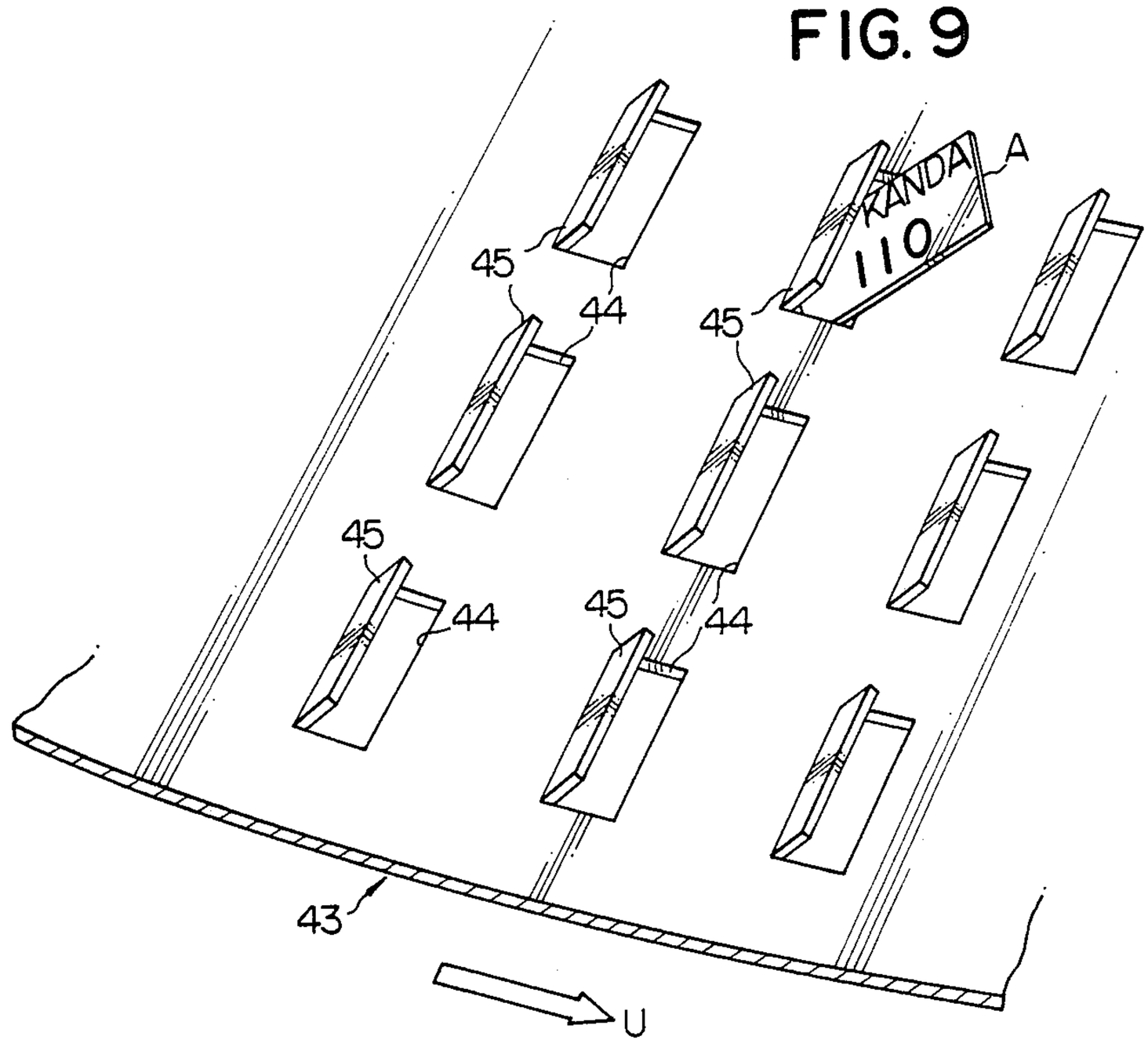
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FIG. 10

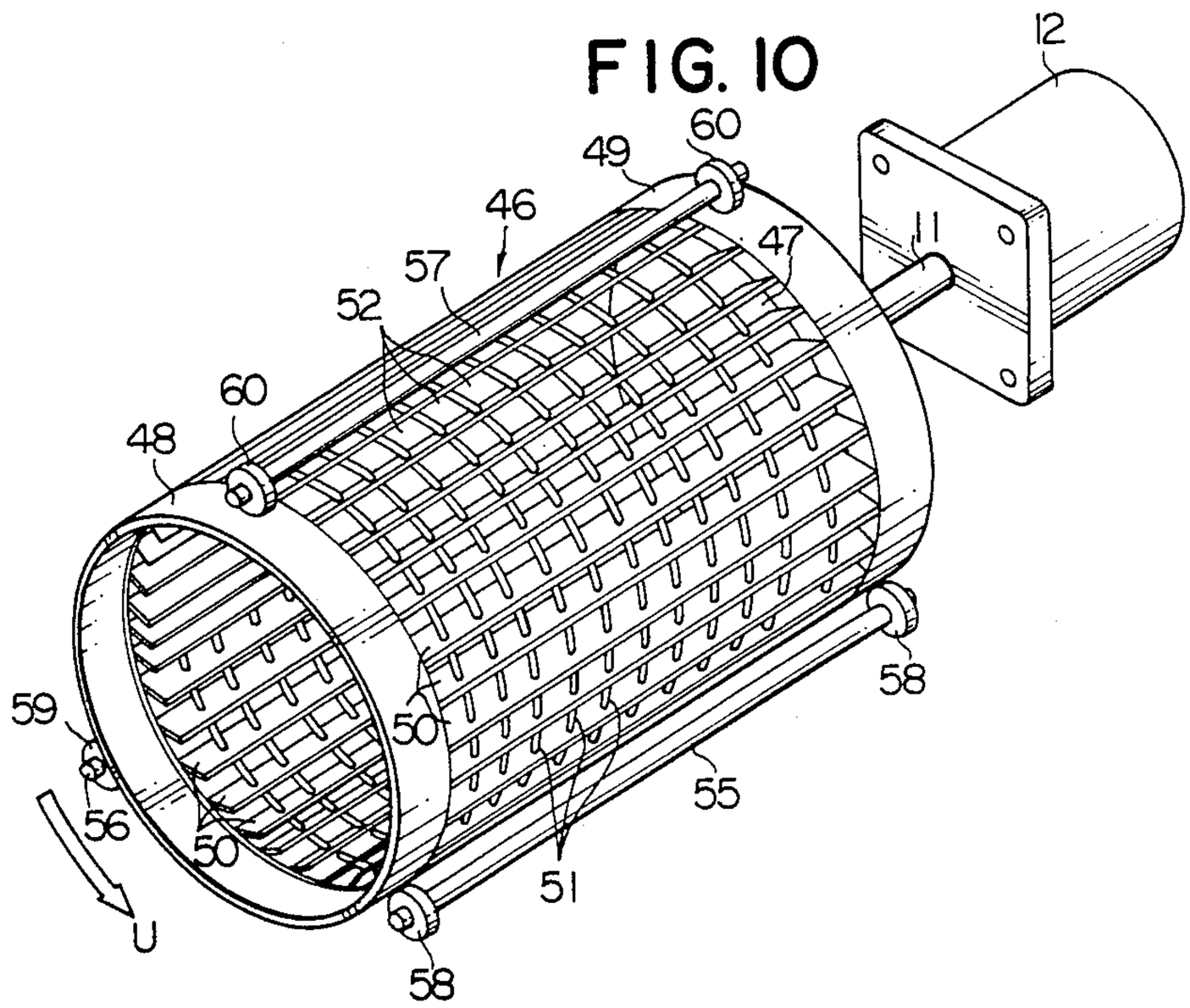
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FIG. 11

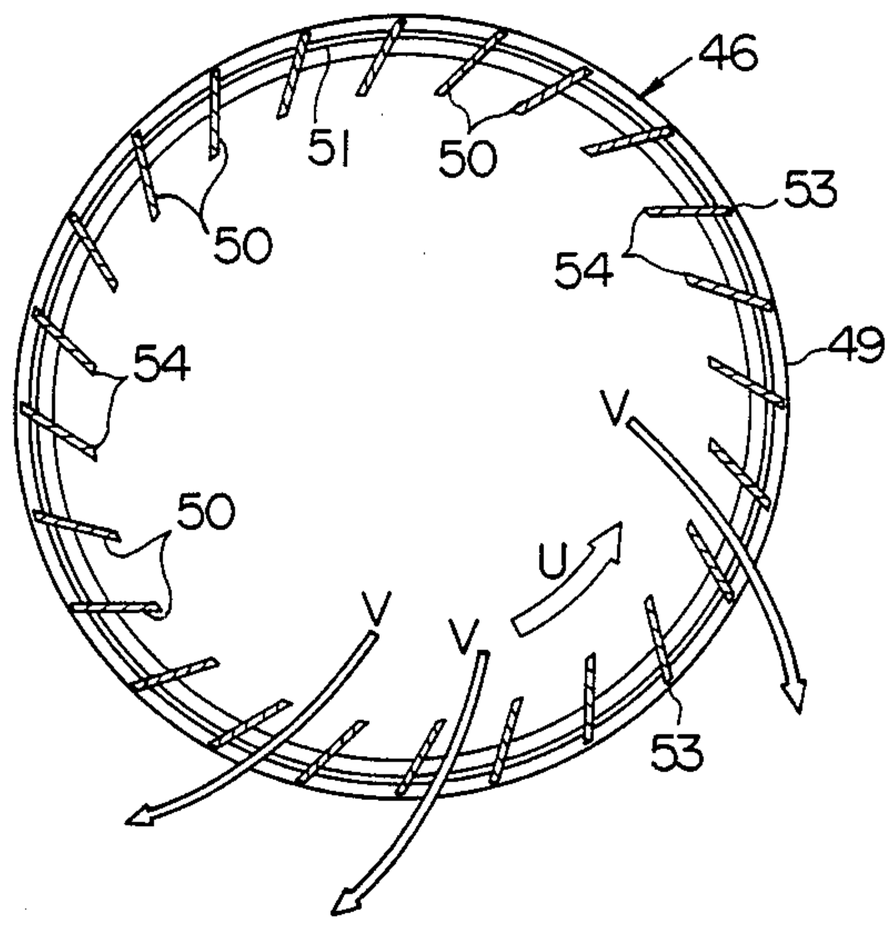
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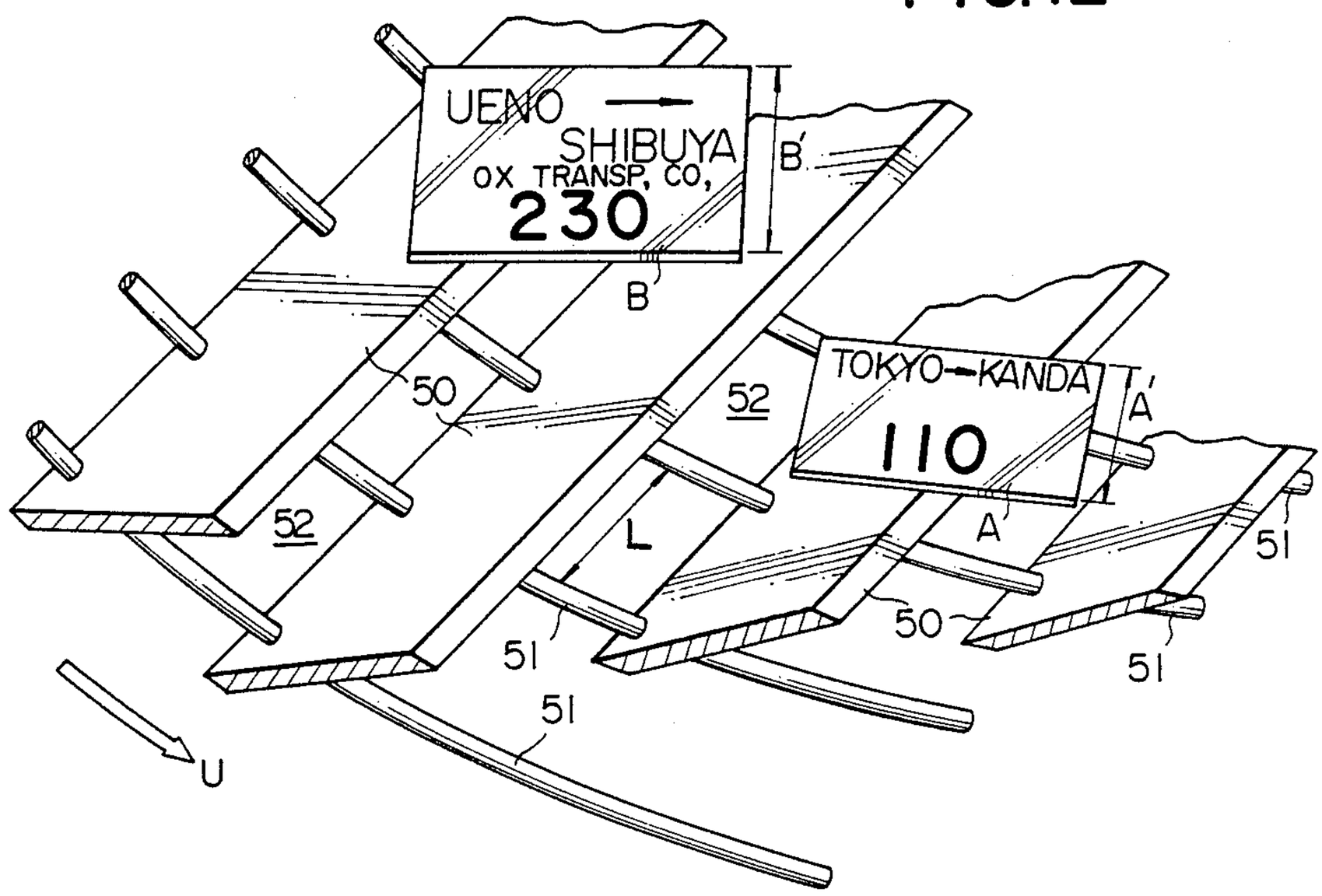
FIG. 12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SHIBUYA
OX TRANSP, CO,
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FIG. 13

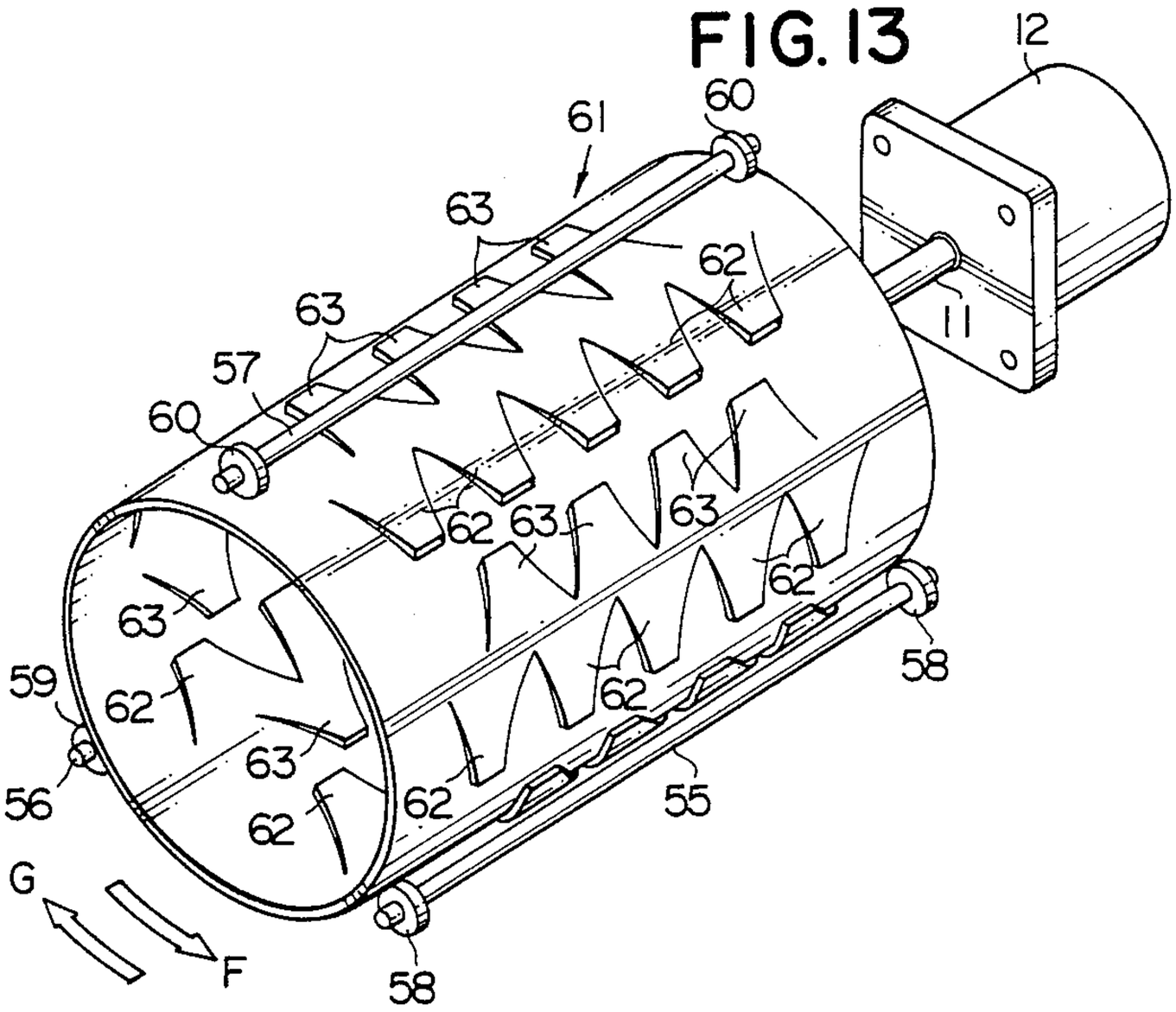
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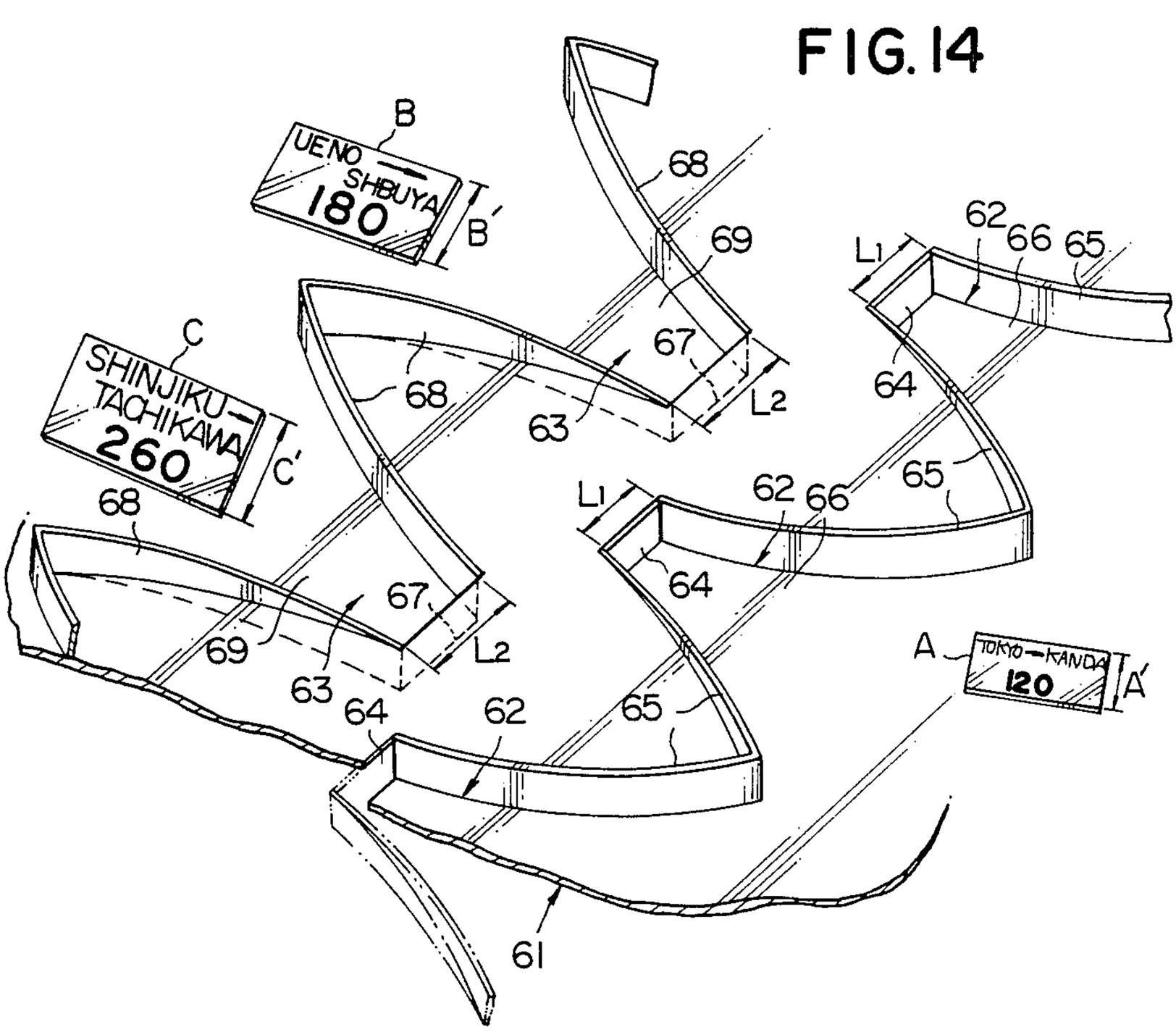
FIG. 14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L2
L1
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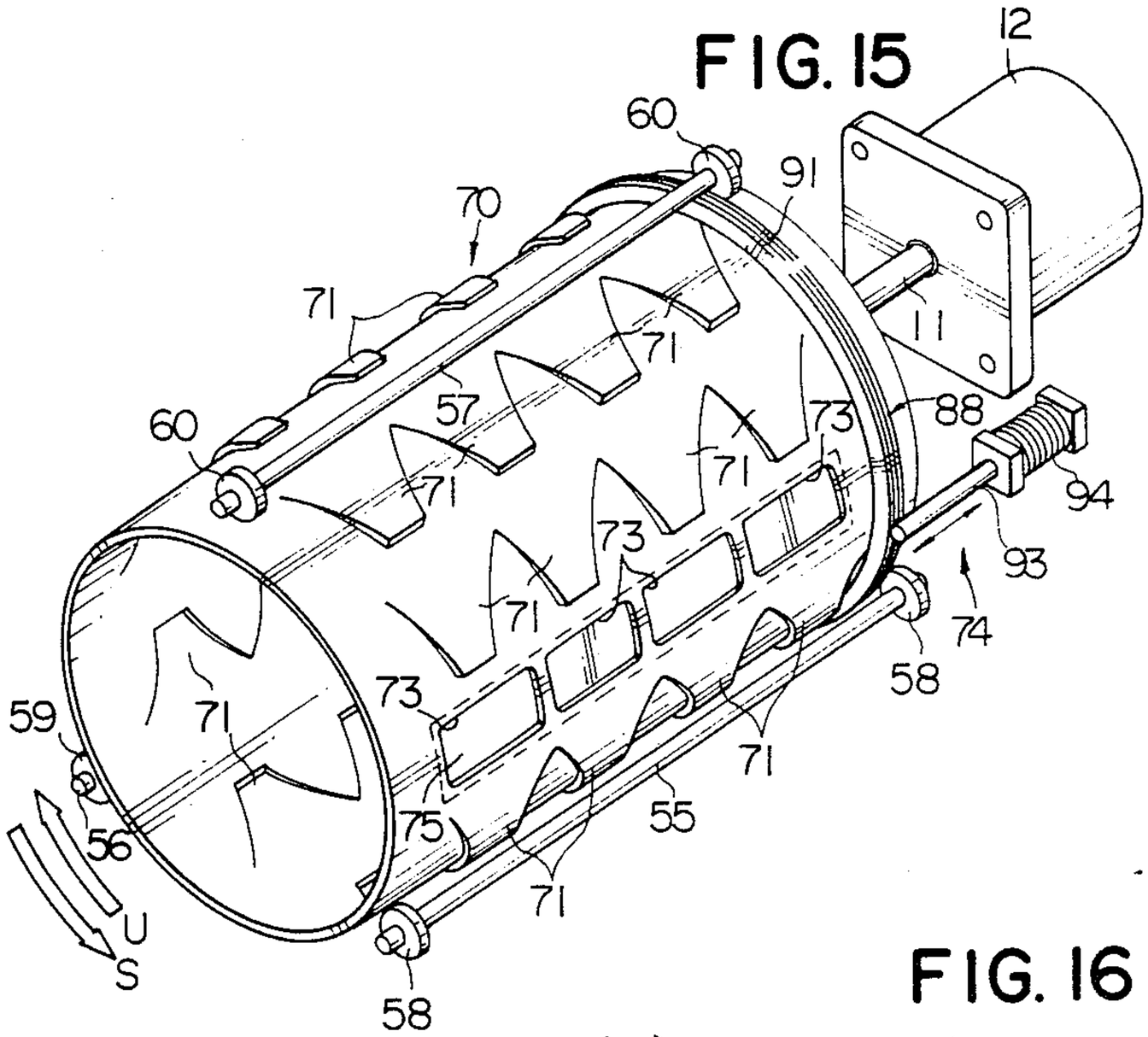
63
61

FIG. 15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U
S

FIG. 16

L
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B'
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A'
U

FIG. 17

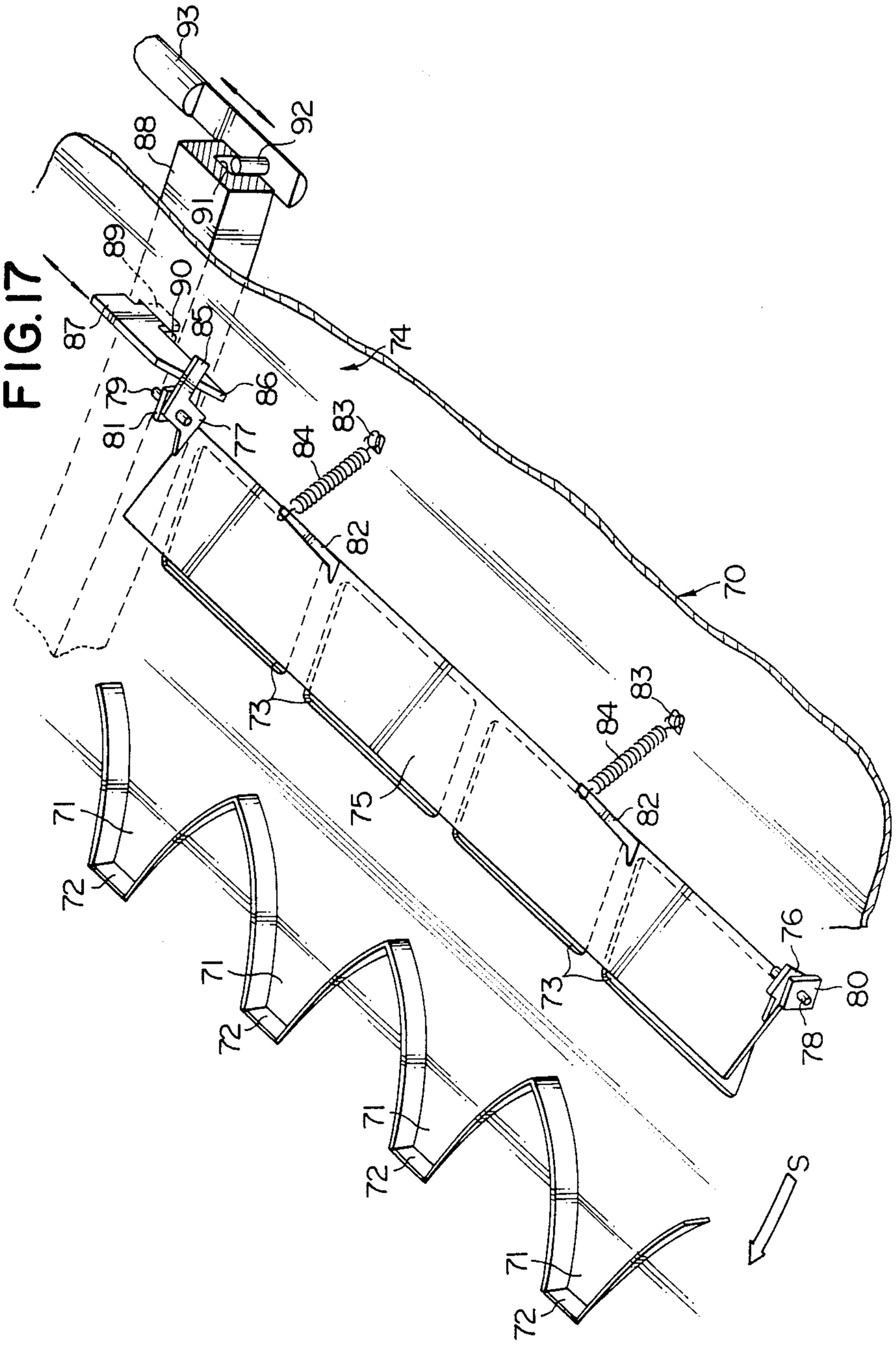

FIG. 18

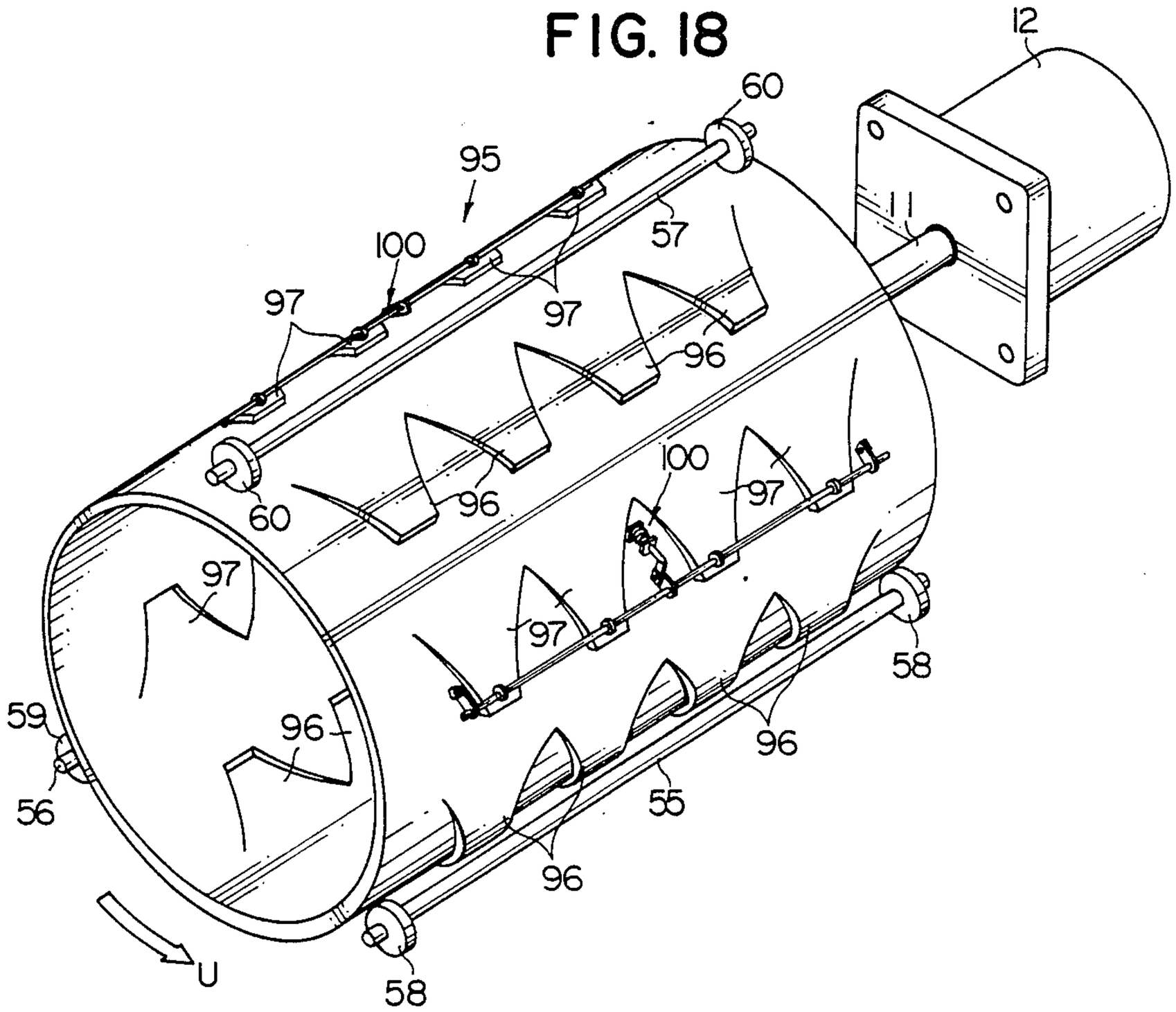

FIG. 19

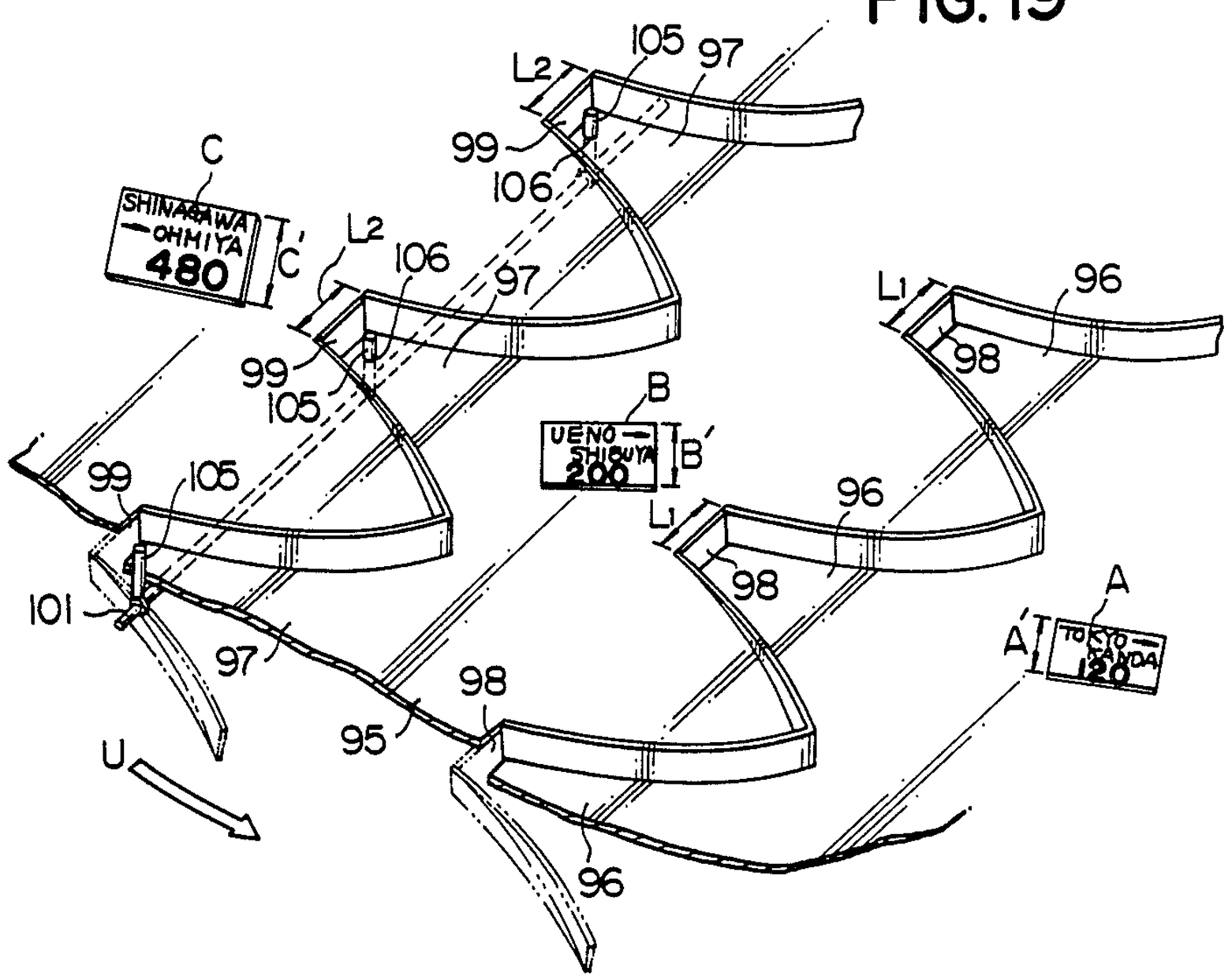
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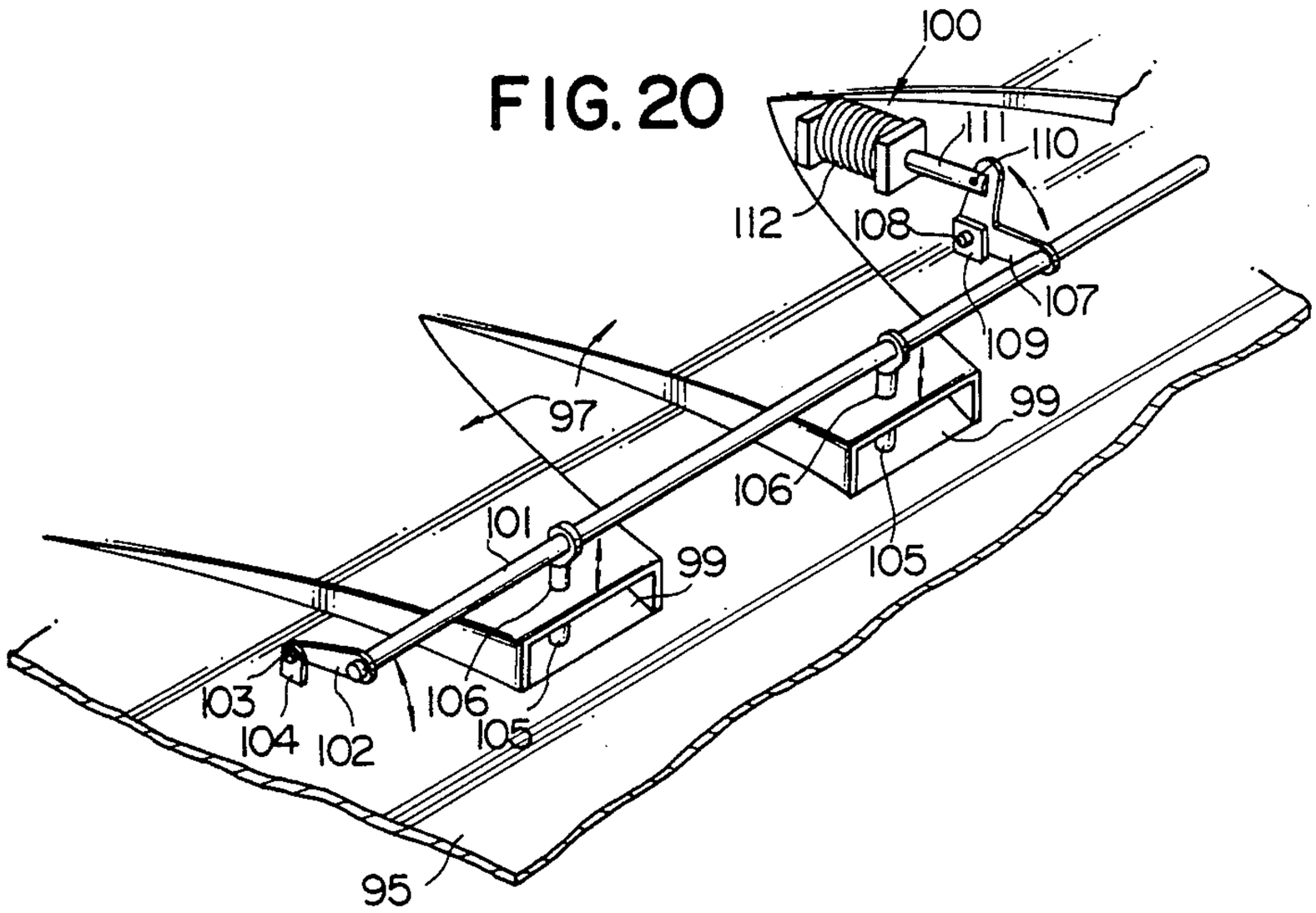
FIG. 20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SORTING DEVICE

This is a continuation of application Ser. No. 742,693, filed June 7, 1985, now abandoned, which is a division of Ser. No. 470,720 filed Feb. 28, 1983, now U.S. Pat. No. 4,535,898.

BACKGROUND OF THE INVENTION

The present invention relates to a sorting device for sorting out differently sized thin pieces such as tickets, metal pieces, coins, or other tokens according to their size.

Small articles of different sizes can manually be sorted out according to their size, but the manual sorting operation has been time-consuming and subjected to errors. Various automatic sorting mechanisms have heretofore been used for mechanically or electrically classifying and sorting out different kinds of pieces according to their size. Though the known automatic sorters are highly effective to sort out relatively heavy and thick objects such as coins or nuts, the mechanisms fail to divide relatively light and thin pieces into groups according to their size. No sorting device has been developed which is capable of sorting out light and thin articles without suffering from errors. It has therefore been customary practice to resort to manual procedures for sorting out pieces of paper such as tickets, pieces of cloth, or thin pieces of metal.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a sorting device of a simple structure for sorting out a large number of lightweight and thin pieces of different sizes according to their size.

Another object of the present invention is to provide a sorting device for automatically sorting out differently sized pieces efficiently in a short period of time.

According to the present invention, there is provided a sorting device for sorting out a multiplicity of pieces such as tickets according to their size, the device comprising a cylindrical sorter drum rotatably mounted in a frame for storing therein pieces having different sizes to be sorted out, means on the sorter drum including openings for passing therethrough pieces of a particular size only; and means for rotating the sorter drum about its own axis to cause the pieces of the particular size to be discharged through the openings out of the sorter drum.

The above and other objects, features and advantages of the present invention will become more apparent from the following description when taken in conjunction with the accompanying drawings in which preferred embodiments of the present invention are shown by way of illustrative example.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a sorting device according to the present invention;

FIG. **2** is a perspective view of the sorting device shown in FIG. **1** with a collector box pulled out and a ticket charger lifted;

FIG. **3** is a perspective view of a sorter drum mounted in the sorting device shown in FIG. **1**;

FIG. **4** is an enlarged fragmentary perspective view of the sorter drum shown in FIG. **3**;

FIGS. **5** and **6** are perspective views of sorter drums according to modifications;

FIG. **7** is a perspective view of a sorter drum according to another embodiment;

FIG. **8** is an enlarged fragmentary perspective view of the sorter drum shown in FIG. **7**;

FIG. **9** is an enlarged fragmentary perspective view of a modified sorter drum;

FIG. **10** is a perspective view of a sorter drum according to still another embodiment;

FIG. **11** is a transverse cross-sectional view of the sorter drum illustrated in FIG. **10**;

FIG. **12** is an enlarged fragmentary perspective view of the sorter drum shown in FIG. **11**;

FIG. **13** is a perspective view of a sorter drum according to still another embodiment;

FIG. **14** is an enlarged fragmentary perspective view of the sorter drum shown in FIG. **13**;

FIG. **15** is a perspective view of a sorter drum according to a still further embodiment;

FIG. **16** is an enlarged fragmentary perspective view of the sorter drum shown in FIG. **15**;

FIG. **17** is an enlarged fragmentary perspective view of the sorter drum shown in FIG. **15**, the view being illustrative of a mechanism for opening and closing discharge holes;

FIG. **18** is a perspective view of a sorter drum according to a still further embodiment;

FIG. **19** is an enlarged fragmentary perspective view of the sorter drum illustrated in FIG. **18**; and

FIG. **20** is an enlarged fragmentary perspective view of the sorter drum of FIG. **18**, showing a discharge control mechanism.

DETAILED DESCRIPTION

The present invention is particularly useful when embodied in device as shown for sorting out rectangular pieces of paper such as tickets according to their size. However, the sorting device can also be used to sort out other thin, lightweight pieces or articles such as coins, pieces of cloth, or the like according to their size.

As illustrated in FIGS. **1** and **2**, a sorting device comprises a body or frame **1** from which depend a pair of legs **2** spaced laterally from each other, and a collector box **3** opening upwardly and removably interposed between the legs **2**. The frame **1** has on a side thereof a control panel **4** having switches and lamps. A ticket charger **5** is pivotably connected by hinges **6** to an upper edge of the frame **1**, and is of a triangle cross section. The ticket charger **5** has an upper trapezoidal opening and a charging hole **7** in its side which normally faces the frame **1**. The ticket charger **5** also includes a slanted chute **8** extending through the charging hole **7** into the frame **1** when the ticket charger **5** is in the ticket charging position as shown in FIG. **1**. As shown in FIG. **2**, the collector box **3** can laterally be slid out, and the ticket charger **5** can be angularly moved to an upper position in which the ticket charger **5** is placed on an upper surface of the frame **1**. The frame **1** has a circular opening **9** in the side thereof on which the ticket charger **5** is mounted. A sorter drum **10** is housed in the frame **1** and has an open end substantially in registry with the circular opening **9**. When the ticket charger **5** is in the ticket charging position, the circular opening **9** is covered with the ticket charger **5** with the chute **8** of the ticket charger **5** extending through the circular opening **9** into the sorter drum **10**. When the ticket charger **5** is lifted as shown in FIG. **2**, the circular opening **9** is exposed to provide access into the sorter drum **10** therethrough.

As illustrated in FIGS. **3** and **4**, the sorter drum **10** has a hollow cylindrical wall of thin metal sheet having one end open (lefthand as shown) and the other end closed off to which is concentrically connected a drive shaft **11** coupled to a motor **12**. The sorter drum **10** has a central axis extending horizontally, and is rotatably supported by a pair of support shafts **13**, **14** laterally spaced from such other and extending axially parallel to and below the sorter drum **10**, the support shafts **13**, **14** having rollers **15**, **16** held in rolling engagement with the cylindrical wall of the sorter drum **10**.

The sorter drum **10** has a plurality of parallel rows of tapered tongues **17** sheared off the cylindrical wall radially outwardly thereof and extending circumferentially of the cylindrical wall, the rows of the tapered tongues **17** extending axially of the sorter drum **10** and circumferentially spaced from adjacent ones. In the illustrated embodiment, the tapered tongues **17** in each row are four in number. Each of the tapered tongues **17** includes an end edge **23** and a pair of parabolically converging side edges **24**, **25** extending from the cylindrical wall to the end edge **23**. The end edge **23** is displaced radially outwardly from the cylindrical wall to define therewith an opening **21** extending radially outwardly and having a height H and a length L that are selected to allow passage of tickets of a particular size through the opening **21**. Accordingly, the tapered tongues **17** terminate respectively in the openings **21** and are progressively narrower toward the openings **21** to provide tapered slide surfaces **18**. In each row of the tapered tongues, the adjacent ones are paired and the paired tapered tongues define therebetween a bullet-shaped separator **19** as shown in FIG. **4**. A guide strip **20** extends along each of the parabolic side edges **24**, **25**, and is secured to both the side edge and the cylindrical wall, as best illustrated in FIG. **4**. The guide strips **20** as paired on both sides of each slide surface **18** thus provide a chute for guiding tickets to be sorted out toward the opening **21**. More specifically, one end of each guide strip **20** is located at the distal end of the slide surface **18** and serves to define the opening **21**, while the other end is positioned at the opposite end of the slide surface **18** which blends into the cylindrical wall of the sorter drum **10**, and protrudes radially inwardly of the sorter drum **10**. The guide strips **20** disposed one on each side of the separator **19** between the paired tapered tongues **17** are joined at their ends remote from the openings **21** and substantially assume a V shape surrounding the separator **19**.

Operation of the sorting device thus constructed is as follows: Where two kinds of tickets A, B of different sizes (FIG. **4**) dependent on printed fares are to be sorted out, the sorting device is assembled as shown in FIG. **1**, and a mixture of tickets A, B is introduced through the upper opening of the ticket charger **5** down the chute **8** into the sorter drum **10** in the frame **1**. Then, the start switch on the control panel **4** is turned on to start the motor **12** which rotates the drive shaft **11** to rotate the sorter drum **10** in the direction of the arrow U (FIG. **3**), in which the pointed ends of the separators **19** lead the openings **21**. The mixed tickets A, B are collected at a lower portion in the sorter drum **10** as they slide and tumble therein, and are gathered by the guide strips **20** in the directions of the arrows X, Y, Z onto the slide surfaces **18** between the opposite guide strips **20**. The tickets A of a smaller size are permitted to flow in the direction of the arrow W through the openings **21** out of the sorter drum **10** as the openings **21** are dimensioned to allow the tickets A to pass longitudinally therethrough. The tickets A as discharged through the openings **21** are received in the collector box **3**. The tickets B, which are larger than the tickets A, are large enough to be rejected by the openings **21**, and either get caught by the guide strips **20** before reaching the openings **21** or are forced to flow over the openings **21**, so that the tickets B will remain in the sorter drum **10** without being discharged. When the sorting operation has been finished, the motor **12** is de-energized by a timer switch, for example, to stop the sorter drum **10**, and the collector box **3** is pulled out to transfer the collected tickets A into another storage box. The ticket charger **5** is then turned upwardly about the hinges **6** to uncover the circular opening **9**, through which the tickets B can be picked up from the sorter drum **10** by hand or a vacuum suction device for separate storage.

The sorting device can thus sort out differently sized tickets automatically in a relatively short period of time. While the sorter drum **10** is in rotation, the separators **19** and the guide strips **20** can guide the tickets effectively onto the slide surfaces **18** leading to the openings **21** so that the tickets will forcibly be sorted out at an increased rate.

FIG. **5** shows a modified sorter drum **26** having an annular plate **27** mounted in an open end of the sorter drum **26** at a position slightly displaced off the end of the sorter drum **26**, the annular plate **27** having a central circular hole **28**. Where the sorter drum **26** is mounted in the frame **1** as illustrated in FIG. **1**, the chute **8** of the ticket charger **5** as it is in the ticket charging position has a distal end projecting into the central hole **28** in the annular plate **27**. The annular plate **27** serves to prevent tickets contained in the sorter drum **26** from accidentally going out through the open end of the sorter drum **26** while the latter is at rest or in rotation.

Another modified sorter drum **29** is illustrated in FIG. **6**. The sorter drum **29** has a plurality of trapezoidal holes **30** (only one shown) each of which is covered with a separate trapezoidal tongue **31** that is substantially complementary in shape to the trapezoidal hole **30**. The tongue **31** has a pair of tapered side walls **32**, **32** each including a pair of mounting tabs **33**, **33** at its ends. The tongue **31** is fastened to the sorter drum **29** on its outer circumferential surface in covering relation to the hole **30** by screws **34** extending through the tabs **33**, respectively, threadedly into the sorter drum **29**. Each of the side walls **32**, **32** has its width progressively larger from the wider end of the tongue **31** toward the shorter end thereof, so that when the tongue **31** is mounted on the sorter drum **29**, they jointly form an opening for passage therethrough of tickets of a particular size.

FIGS. **7** and **8** illustrate a sorter drum **35** according to another embodiment of the present invention. The sorter drum **35** is in the form of a hollow cylindrical wall with one end open and the other end closed and connected concentrically to the drive shaft **11**. The sorter drum **35** is rotatably supported by three angularly equidistant support shafts **36**, **37**, **38** having end and central rollers **39**, **40**, **41**, respectivley, held in rolling engagement with the cylindrical wall. The cylindrical wall has a plurality of rows and columns of rectangular openings **42** defined in and extending radially through the cylindrical wall for passage therethrough of tickets of a particular size. The rows of openings **42** extend axially of the sorter drum **35** at equal intervals and the columns of openings **42** extend circumferentially of the sorter drum **35** at equal intervals, the columns being six

in number in the illustrated embodiment. Each of the rectangular openings **42** has its longitudinal axis oriented axially of the sorter drum **35**, and has a length L larger than the width A' of smaller tickets A and smaller than the width B' of larger tickets B, the tickets A, B being differently sized according to their printed fares.

The sorting device with the sorter drum **35** mounted therein will operate as follows: With the tickets A, B placed in the sorter drum **35**, the sorter drum **35** is rotated in the direction of the arrow U about its axis by the motor **12**. As the sorter drum **35** rotates, the tickets A, B are slid on the inner peripheral surface of the sorter drum **35** and caught at their corners or edges by the openings **42**. Because of the limited length L of the openings **42**, only the narrower tickets A are allowed to pass through the openings **42**, while the wider tickets B are prevented from going therethrough but remain within the sorter drum **35**. The tickets A as they are discharged through the openings **42** fall into the collector box. The sorter drum **35** continues to rotate until the motor **12** is de-energized as by a timer switch to stop the sorter drum **35**. Then, the collector box is removed to retrieve the tickets A, and the ticket discharger is opened to take out the tickets B from the sorter drum **35**.

The arrangement shown in FIGS. **7** and **8** is advantageous in that the tickets A can be sorted out in a relatively short interval of time as there are many openings **42** defined in the sorter drum **35** to catch the tickets A highly efficiently.

FIG. **9** shows a modified sorter drum **43** having a plurality of rectangular openings **44** arranged in axial rows and circumferential columns, and a plurality of rectangular baffling plates **45** projecting obliquely radially inwardly of the sorter drum **43** in overhanging relation to the openings **44**, respectively, and extending longitudinally therealong. When the sorter drum **43** rotates in the direction of the arrow U, tickets A can be caught by the baffling plates **45** and guided thereby into the openings **44** for being discharged therethrough. The baffling plates **45** can be formed by being bent inwardly when the openings **44** are defined in blanking operation.

FIGS. **10** through **12** show a sorter drum **46** according to still another embodiment of the present invention. The sorter drum **46** comprises a cage-shaped cylindrical body having a circular bottom **47** at an axial end thereof to which the drive shaft **11** of the motor **12** is concentrically connected, an end ring **48** defining an open end remote from the bottom **47** in coaxial relation thereto, and an annular flange **49** mounted on the bottom **47** and axially spaced from the end ring **48**. The end ring **48** and the bottom **47** with the annular flange **49** are made of thin steel plates and have equal diameters The sorter drum **46** also includes a plurality of elongate partitions **50** extending axially between the end ring **48** and the annular flange **49** and equally spaced circumferentially of the sorter drum **46**, and a plurality of reinforcement rings **51** in the form of thin annular wires extending circumferentially of the sorter drum **46** through apertures (not shown) defined in the elongate partitions **50** and equally spaced axially of the sorter drum **46**. The reinforcement rings **51** serve as ticket size limiters that cooperate with the elongate partitions **50** in defining rectangular openings **52** through which tickets of a certain size can pass As shown in FIG. **11**, each of the elongate partitions **50** lies in a plane extending off the central axis of the sorter drum **46** at an angle with respect to the reinforcement rings **51**. The reinforcement rings **51** are held in substantially axial alignment with the end ring **48** and the annular flange **49**. Each of the elongate partitions **50** has a radially outward longitudinal edge **53** substantially axially aligned with the end ring **48** and the annular flange **49** and a radially inward longitudinal edge **54** positioned radially inwardly of the end ring **48** and the annular flange **49**.

The sorter drum **46** is supported horizontally by three support shafts **55**, **56**, **57** having rollers **58**, **59**, **60**, respectively, which rollingly engage the end ring **48** and the annular flange **49** on their outer circumferential surfaces.

As shown in FIG. **12**, adjacent two of the reinforcement rings **51** are spaced from each other by a distance L which is larger than the width A' of a smaller ticket A but smaller than the width B' of a larger ticket B. In operation, when the sorter drum **46** is rotated by the motor **12** with a mixture of tickets A, B stored in the sorter drum **46**, the tickets A, B are caused to tumble in the sorter drum **46** and tend to get caught by the partitions **50**. At this time, only the tickets A are allowed to pass longitudinally through the rectangular openings **52** defined by the partitions **50** and the reinforcement rings **51**, and therefore are discharged in the directions of the arrows V (FIG. **11**) out of the sorter drum **46** into the ticket collector box below the sorter drum **46**. The larger tickets B remain trapped in the sorter drum **46**, and will be collected.through the open end of the latter at a later time. The sorter drum **46** as illustrated in FIGS. **10** through **12** is advantageous in that it has more openings for passage therethrough of tickets of a particular dimension, and therefore can sort out a greater number of such tickets in a shorter period of time and hence with a higher efficiency.

FIGS. **13** and **14** are illustrative of a sorter drum **61** according to still another embodiment of the present invention. The sorter drum **61** is hollow and has a cylindrical thin metal wall with one end open and the other end closed to which is concentrically connected the drive shaft **11** of the motor **12**. The sorter drum **61** has a plurality of first rows of tapered tongues **62** sheared off the cylindrical wall radially outwardly thereof and extending circumferentially of the cylindrical wall, and a plurality of second rows of tapered tongues **63** sheared off the cylindrical wall radially outwardly thereof and extending circumferentially of the cylindrical wall. The first and second rows of tongues **62**, **63** alternate in the circumferential direction of the cylindrical wall, and each row of the tapered tongues **62**, **63** extends axially of the sorter drum **61**. In the illustrated embodiment, the tapered tongues **62** in-each first row are five in number, and the tapered tongues **63** in each second row are four in number. As better shown in FIG. **14**, each tapered tongue **62** in each first row has a distal end edge displaced radially outwardly off the cylindrical wall to define therewith a rectangular opening **64** having a length **L1**, and a pair of converging side edges along which extend guide strips **65**, respectively, to provide a tapered slide surface **66**. Likewise, each tapered tongue **63** in each first row has a distal end edge displaced radially outwardly off the cylindrical wall to define therewith a rectangular opening **67** having a length **L2**, and a pair of converging side edges along which extend guide strips **68**, respectively, to provide a tapered slide surface **69**. The length **L1** of each opening **64** is smaller than the length **L2** of each opening **67** so that the openings **64** can admit tickets A having a smaller width A' and the openings **67** can admit tickets B having a me-

dium width B' larger than the width A', and both of the openings **64**, **67** can reject ticket C having a larger width C' larger than the widths A', B'. The openings **64** in each first row are oriented circumferentially of the sorter drum **61** in one direction of rotation thereof, while the openings **67** in each second row are oriented circumferentially of the sorter drum **61** in an opposite direction of rotation thereof. Stated otherwise, the tapered tongues **62** and the tapered tongues **63** are directed circumferentially in opposite directions and axially staggered with respect to each other.

The tickets A, B, C are differently sized according to their printed fares. When the sorter drum **61** is rotated first in the direction of the arrow F by the motor **12** with a mixture of tickets A, B, C contained in the sorter drum **61**, the tickets A, B, C are collected by the guide strips **65** onto the tapered slide surfaces **66** toward the openings **64** while the tickets are tumbling and being slid down the inner circumferential surface of the sorter drum **61** due to gravity. Since the openings **64** are of the length L1 larger than the width A' of the tickets A but smaller than the widths B', C' of the tickets B, C, only the tickets A are allowed to pass through the openings **64** out of the sorter drum **61** into the ticket collector box disposed below the sorter drum **61**, and the tickets B, C are rejected and remain in the sorter drum **61**. After all the tickets A have been discharged out of the sorter drum **61**, the motor **12** is de-energized as by a timer switch to stop the sorter drum **61**, and the ticket collector box is pulled out to pick up the collected tickets A. The empty ticket collector box is inserted again below the sorter drum **61**, and then the motor **12** is turned on to rotate the sorter drum **61** in the direction of the arrow G. The tickets B, C are then collected by the guide strips **68** onto the slide surfaces **69**, and only the medium-sized tickets B are discharged through the openings **67** out of the sorter drum **61** into the ticket collector box, while the largest tickets C are prevented from being discharged and remain trapped in the sorter drum **61**. After the tickets B have been discharged, the motor **12** is stopped and the tickets B are retrieved from the ticket collector box after it has been pulled out. The tickets C can be picked up from the sorter drum **61** through the open end thereof. With the embodiment of FIGS. **13** and **14**, tickets of different sizes can be sorted out automatically in a short period of time by rotating the sorter drum **61** in opposite directions.

According to a still further embodiment illustrated in FIGS. **15** through **17**, a sorter drum **70** is in the form of a cylindrical wall having a plurality of rows of tapered tongues **71** which are of the same construction as that of the tapered tongues **17** shown in FIG. **3** and which define rectangular openings **72** for passage therethrough of tickets A of a smaller size, as illustrated in FIG. **16**. The sorter drum **70** additionally has a row of rectangular discharge holes **73** defined in the cylindrical wall and arranged axially thereof, and a mechanism **74** mounted on the cylindrical wall for opening and closing the discharge openings **73**. The sorter drum **70** is designed to sort out tickets A, B (FIG. **16**) of different sizes. The rectangular openings **72** have a length L larger than the width A' of the tickets A but smaller than the width B' of the tickets B, so that the openings **72** allow only the tickets A to pass therethrough. The rectangular discharge holes **73** are dimensioned to pass the tickets B therethrough when the discharge holes **73** are opened by the mechanism **74**.

As shown in FIG. **17**, the mechanism **74** comprises an elongate cover **75** pivotably mounted on the cylindrical wall over the discharge holes **73** and having a pair of end supports **76**, **77** having pins **78**, **79**, respectively, journalled in bearing members **80**, **81**, respectively, disposed oh the cylindrical wall. The cover **75** also has a pair of spaced arms **82**, **82** coupled to hooks **83**, **83**, respectively, on the cylindrical wall by springs **84**, **84** which normally urge the cover **75** in a direction to open the discharge holes **73**. The support **77** includes a cam follower **85** held in slidable engagement with a slanted surface **86** of a cam **87**. An annular control member **88** .s disposed around the cylindrical wall and supports thereon the cam **87**, which has a connector **89** extending through a slot **90** defined in the cylindrical wall. The annular control member **88** has a groove **91** opening radially outwardly and receiving slidably therein a pin **92** projecting from a rod **93** extending in the axial direct.on of the sorter drum **70** from a solenoid **94** disposed adjacent to the motor **12**.

To sort out the tickets A, B stored in the sorter drum **70**, the sorter drum **70** is rotated by the motor **12** in the direction of the arrow U to collect the tickets A, B onto the tapered tongues **71**. At this time, the solenoid **94** remains de-energized to extend the rod **93** for thereby displace the annular control member **88** axially away from the solenoid **94** until the cam **87** causes the cam follower **85** to move upwardly as shown in FIG. **17**. Therefore, the cover **75** is lowered into engagement with the inner circumferential surface of the sorter drum **70**, closing the discharge openings **73**. No tickets are allowed to pass through the discharge openings **73**. The rotation of the sorter drum **70** forces the tickets A, B toward the openings **72**, but only the tickets A of a smaller dimension are permitted to be discharged through the openings **72** with the larger tickets B prevented from passing through the openings **72**.

The discharged tickets A are collected in the ticket collector box, which is then pulled out for ticket retrieval after the motor **12** has been turned off to stop the sorter drum **70**. The tickets B which remain within the sorter drum **70** can be collected from the latter by placing the empty ticket collector box below the sorter drum **70**, energizing the solenoid **94** to pull the rod **93** and hence the annular control member **88** for allowing the cam follower **85** to slide down the cam **87** as it is retracted, for thereby erecting the cover **75** radially inwardly into the sorter drum **70** to uncover the discharge openings **73** under the resiliency of the springs **84**, and rotating the sorter drum **70** with the motor **12** in the direction of the arrow S which is opposite to the direction of the arrow U. The tickets B are then discharged through the discharge openings **73** out of the sorter drum **70** into the ticket collector box. Thereafter, the sorter drum **70** is stopped and the ticket collector box is withdrawn to retrieve the collected tickets B therefrom.

FIGS. **18** through **20** shows a sorter drum **95** constructed in accordance with a still further embodiment of the present invention. The sorter drum **95** comprises a cylindrical wall including an open end and a closed end coupled to the drive shaft **11** of the motor **12**. The sorter drum **95** has a plurality of first rows of tapered tongues **96** and a plurality of second rows of tapered tongues **97** alternating circumferentially with the first rows of tapered tongues **96**. The first and second rows of tapered tongues **96**, **97** extend axially of the sorter drum **95**. In the illustrated embodiment, the tapered

tongues in each row are four in number. The tapered tongues **96, 97** are substantially the same in construction as the tapered tongues **17** as shown in FIGS. **15, 16, 17** except that the tapered tongues **96** define rectantular openings **98** and the tapered tongues **97** define rectangular openings **99** larger than the rectangular openings **98**. The tapered tongues **96, 97** in each row extend circumferentially in the same direction, that is, the openings **98, 99** are oriented in one direction of rotation of the sorter drum **95**. Each rectangular opening **98** has a length L1 greater than the width A' of smallest tickets A to be sorted out but smaller than the width B' of the tickets B, and each rectangular opening **99** has a length L2 larger than the width B' of medium tickets B sorted out but smaller than the width C' of largest tickets C.

The sorter drum **95** also has a discharge control mechanism **100** associated with each of the second rows of tapered tongues **97** and disposed on the outer circumferential surface of the cylindrical wall for selectively preventing passage of the tickets B through the openings **99**. The discharge control mechanism **100** comprises, as better shown in FIG. **20**, a control rod **101** pivotably supported on the cylindrical wall and extending axially thereof along the second row of tapered tongues **97**, the control rod **101** having end arms **102** which are pivotably connected by pins **103** to supports **104** mounted on the cylindrical wall. A plurality of control pins **105** are mounted on the control rod **101** at spaced intervals therealong and extending through apertures **106** defined in the tapered tongues **97** in a direction centrally across the openings **99**. The control rod **101** is centrally connected to one arm of an L-shaped lever **107** having at a central portion thereof a pivot pin **108** journalled on a support **109** mounted on the cylindrical wall. The other arm of the L-shaped lever **107** is pivotably coupled by a pin **110** to a rod **111** of a solenoid **112** installed on the cylindrical wall of the sorter drum **95** between adjacent two of the tapered tongues **97**.

When the tickets A, B, C are to be sorted out, they are placed in the sorter drum **95** and then the latter is driven by the motor **12** to rotate about its own axis in the direction of the arrow U. At this time, the solenoid **112** remain de-energized to let the control pins **105** project across the openings **99**. The tickets A, B, C are caused to tumble and slide down as they are collected onto the tapered tongues **96, 97**. Since the openings **98** are dimensioned to admit the tickets A only, the tickets A are allowed to pass through the openings **98** while the tickets B, C are prevented from being discharged out. The openings **99** are closed by the control pins **105** which reject the tickets A, B. The discharged tickets A are received in the ticket collector box located below the sorter drum **95**. After all the tickets A have been collected, the motor **12** is turned off as by a timer switch to stop the sorter drum **95**, and the ticket collector box is pulled out to retrieve the tickets A. The empty ticket collector box is placed below the sorter drum **95**, and the motor **12** is energized again to rotate the sorter drum **95** in the direction of the arrow U. Simultaneously, the solenoid **112** is energized to retract the rod **111** for thereby causing the L-shaped lever **107** to move the control rod **101** away from the sorter drum **95** until the control pins **105** are lifted clear out of the openings **99**. With the openings **99** open, the tickets B are permitted to be discharged therethrough out of the sorter drum **95** into the ticket collector box, leaving only the tickets C in the sorter drum **95**. When the tickets B have completely been collected, the motor **12** is turned off again, and the ticket collector box is removed again in order to pick up the tickets B therefrom. The tickets C can then be taken out of the sorter drum **95** through its open end.

Although certain preferred embodiments have been shown and described, it should be understood that many changes and modifications may be made therein without departing from the scope of the appended claims.

What is claimed is:

1. A sorting device for sorting out a multiplicity of pieces according to their size, comprising:

a frame;

a drum rotatably mounted in said frame for storing therein pieces having different sizes to be sorted out, said drum having a cylindrical wall;

first means on said drum including openings for passing therethrough pieces of a particular size only and comprising a plurality of first rows of tapered tongues sheared off said cylindrical wall radially outwardly thereof and extending circumferentially of said cylindrical wall;

second means on said drum including openings for passing therethrough pieces of another particular size only which is different from said first mentioned particular size and comprising a plurality of second rows of tapered tongues sheared off said cylindrical wall radially outwardly thereof and extending circumferentially of said cylindrical wall;

said first and second rows of tapered tongues alternating in the circumferential direction of said cylindrical wall, each row of said tapered tongues extending axially of said drum, said tapered tongues terminating respectively in said openings and being progressively narrower toward said openings for guiding the pieces of a particular size toward said openings, said tapered tongues further having an end edge and a pair of converging side edges extending from said cylindrical wall to said end edge, said end edge being displaced radially outwardly from said cylindrical wall to define therewith one of said openings and said first and second means further including guide strips each extending along one of said edges toward said opening to provide tapered guide passages respectively on said tapered tongues; and

means for rotating said drum about its own axis to cause the pieces of the particular sizes to be discharged through said openings out of said drum.

2. A sorting device according to claim **1**, wherein said tapered tongues in each of said first rows are oriented in a direction of rotation of said drum, and said tapered tongues of said second rows are oriented in a direction opposite to said direction of rotation of said drum.

3. A sorting device according to claim **1**, wherein said tapered tongues of said first and second rows are oriented in a direction of rotation of said drum.

4. A sorting device according to claim **1**, including a plurality of support shafts extending axially parallel to said cylindrical wall and spaced radially from each other, each of said support shafts having a plurality of rollers held in rolling engagement with said cylindrical wall.

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